THE HAVEN-FINDING ART,

OR

THE WAY TO FIND any Hauen or place at sea, by the Latitude and variation.

Lately published in the [illegible] French, and Latine tongues, by commandement of the right honourable *Count Mauritz* of Nassau, high Admiral of the vnited Prouinces of the Low countries, enioyning all Seamen to take charge of ships vnder his iurisdiction, to make diligent obseruation, in all their voyages, according to the directions prescribed herein:

And now translated into English, for the common beneſite of the Seamen of England,

Imprinted at London by G.B.R.N. and R.B.

1599.

THE HAVEN-FINDING ART,

OR

THE WAY TO FIND any Haven or place at Sea, by the Latitude and Variation.

Lately published in the Dutch, French, and Latine tongues, by commandement of the right honourable Court of Admiralty, and high Admiral of the united Provinces of the Low Countries, enjoyning all Seamen diligently to make diligent observation, in all their voyages, according to the directions prescribed herein:

Now translated into English for the common benefit of the Seamen of England.

Imprinted at London by C.B. R.Y. and R.B.

1599.

TO THE RIGHT

Honorable *Charles* Earle of *Notingham*, Baron *Howard* of *Effingham*, knight of the noble Order of the Garter, Lord high Admiral of *England*, *Ireland*, *Wales*, &c. And her Maiestics Lieutenant, and Captaine general ouer all her subiects, leuied in the South parts of this Realme, &c.

RIght Honourable, being informed by my learned friend and most earnest and effectuall furtherer of Nauigation for the common good of his countrey M. Richard Hackluit, vpon the dedication of his first volume of discoueries vnto your Lor. about a yeere since, of the singular affection your Lor. beareth towardes the aduancement of knowledge and skill among our seamen in marine causes; so farre foorth that to the end they might be the more stirred vp and holpen this way, your Lor. would not onely be a meane vnto her Maiestie for the establishing of an ordinary Lecture to be read for their instruction, but also rather then so good a purpose should fall to the ground would be at some charges your selfe for the bringing of it to effect: I conceiued no smal comfort vpon this report,

considering that now of late, the right honorable Count Maurice of Nassavv, L. high Admirall of the vnited Prouinces of the low countries hath shewed himselfe wholly to be of your Lor. minde, thinking it a most principal point for the welfare of their estate to haue their mariners now entring into long voyages to be better informed in matters cõcerning their faculty, thẽ heretofore they haue bene. To which end he hath lately caused a certaine exhortatory iniunction to be published, and hath also giuen commandement that the same should be diligẽtly obserued by all masters of ships and their companies within the same Prouinces. By obseruation whereof they may haue a more certaine and compendious way, whereby they may guide themselues to come to any place they shall desire at sea, with a streighter course, and in shorter time then hath bin commonly accustomed: Which way is to be found by knowledge of the latitude and variation of the place whereto they purpose to go. For seeing one and the same place hath alwaies the same latitude and variation, whereof the one sheweth what situation the place hath between North and South, the other between East and West, it cannot be but that the master of the ship bringing himselfe to the latitude

and

and variation of the place to which he purposeth to go, must needs bring himselfe to the same place also.

Considering therefore howe great profit might hereby redound to seamen if the variations of all places were truely known, the said Count Maurice hath giuen commandement to all that shall take charge of ships, that before they set forth, they should prouide themselues meete instruments for that purpose, that into what place soeuer they shall come, they may diligently search out the declination of the magneticall needle from the true North (which they cõmonly cal the variation of the Compasse) and that after their returne into their owne countrey they should giue a true certificate of those obseruations to the rest of their colleagues and companies of the Admiralty, that by them they may be brought into some good order and method, and so be published for their common good. Desiring also as it may appeare to stirre vp other nations to the same care and diligence in obseruing the variation, he hath caused the said iniunction to be published, not only in his owne natiue tongue, but in the French and Latine also: intending (as it may seeme hereby) to make not only it, but also his honorable desire in furthering this obseruation commonly known to

all Christendome. Desiring therefore, according to the measure of my small abilitie, to be a furtherer of so good a purpose of so famous a personage, I haue done mine indeuour to make the same knowen to all English mariners, by publishing the foresaid Iniunction in their mother tongue: nothing doubting, but as they haue not bene inferiour to any nation, either for excellency of skill, or felicitie in performance of their most wonderfull Nauigations, and that principally in this most happy time of your Lor. enioying your most honorable office of high Admiralty: So, if it might please your Lor. to giue them to vnderstand that your Lor. would be very loth that English mariners (whom I haue knowen to haue had the skill, to finde out places at sea by the latitude & variation, after the same maner that is prescribed in this booke, more then ten yeres since) should now (either for too much sparingnes in not preparing, or for want of diligence in heedful vsing meete instrumẽts for that purpose) cast themselues behinde the Netherlanders; there may assured hope be conceiued, that they wil not only not come behind, but farre exceed, and go beyond them, or any other nation. And so much the rather there is reason to induce vs to be of this opinion, be-

cause

cause there hath bene a secret of the magneticall needle first reuealed by our countriman M. Rob. Norman, wherof other nations as yet seeme to be ignorant, I meane the falling of the North end of the needle touched with the loadstone vnder the horizon. Of which new-found propertie if there shal be diligent and continuall obseruation made, especially in long voyages, there may in all likelihood no lesse profit arise thereby then by the variation.

Considering therefore how greatly your Lor. authority, yea inclination or beck onely mought preuaile to moue the minds of all English mariners to the diligent, heedfull, and continual obseruation of these so rare and wonderful properties of the magneticall needle, at all places wheresoeuer they shall come, wherby so great profit may assuredly redound not onely to seamen, but euen to the whole body of the Christian commonwealth: I was imboldened, recounting with my selfe your Lor. exceeding clemencie conioyned with so high authority to bring before your most honorable presence this Dutch Pilot (as it were, for so I may not vnfitly call this booke) whom since his arriuall here I haue onely taught to speake English that so he might be the more seruiceable vnto your Lor. and to all English

seamen

seamē in that he professeth, which is to bring them to any place in the main Ocean, by a shorter course, then hath bene accustomed. Wherein because the renowmed Count Maurice his master hath giuē him so great credit, as to cōmand him to be imploied by al that take charge of ships vnder his office of admiralty, may it therfore please your L. to affoord him the fauour as to commend him to all English maisters to be thorowly examined by due triall of exact obseruatiō in al places at sea; to the end that if he shall be found indeed to performe so much as he promiseth (wherof there is giuen exceeding great hope by proofe already made by some of our skilfullest English nauigators) he may for euer after be receiued with entertainmēt worthy so notable seruice.

Thus nothing doubting that this Dutch Pilot so highly commended by so worthy a personage, shall find such fauourable acceptation at your L. hands, as in your Lor. high wisedom to him duely appertaineth: I most humbly beseech the Lord of all Lords to increase your Lor. with all true honour in this life, and with endlesse blisse in that life which shal last for euer. 23. Aug. 1599.

Your Lordships most humble
to be commanded.

E. Wright.

TO THE WORSHIP-

full M. *Richard Poulter* the Maister, and brotherhood of Trinitie house, and to all English Mariners and sea-men in generall that loue the pertection of their owne profession, health and happines.

Hauing dedicated this litle Booke to the Right Hon. the Lord high Admirall of England, *to whom the gouernement of sea causes next vnder her Maiestie chiefly appertaineth (with whom also it hath found such fauourable acceptation as of so honorable a personage might be iustly expected) I thought it meete in the next place to commend the same to your Wor. societie also, as to them who haue best occasion in your so manifold nauigations to make most plentifull and sufficient triall thereof, and to whom it may assuredly doe most necessary and profitable seruice. But least you should stand in doubt of this my commendation, the Right Honourable Count* Maurice, *Lord high Admirall of the vnited Prouinces of the Low Countries, hath not only commended the same to all Masters of ships and their companies (or brotherhoods as we may call them) that are vnder his iurisdiction; but hath also commanded them to make diligent and continuall obseruation in all their voyages, according to the directions prescribed herein. He also, as not content that the fruit which may spring hereof should be conteined within the narrow boundes and compasse of the Lowe Countries, hath caused this booke to be translated into the*

French and Latine tongues: endeuouring as it may seeme hereby to make the same knowen to all nations in Christendome. Amongst whom as the Latine translatour M. Hugo de Groot hath chosen the Venetians for their excellencie in Nauigation (as he conceiueth) to whom he might especially dedicate this small Volume togither with his owne labour in translating the same: So I thought it meete to make choise of your worshipfull society, whom I take to be nothing at all inferiour to the Venetians either for excellencie of skill, or for vse and experience in that facultie: and to whom I may more iustly commend this little Booke, euen almost with the same words which Hugo de Groot vseth to the Venetians as followeth.

Therefore that we may enter a little more deepely into the matter, Aristotle the wittiest of all philosophers and the most famous Lawyers doe witnesse that all arts were founde, out of the necessitie of mans nature, that what is wanting in one, might be supplied by that which is abounding in another: and that because euery countrey yeeldeth not all things, there might be a mutual exchange of one thing for another by way of merchandise. But now because diuerse countries are very far distant each from other, that there can be no carriage of any wares or marchandise from the one to the other, either on beasts backs or in cartes: the art of Nauigation was therefore inuented, that the sea might supply the want of dry land. Yet surely skilfull nature hath done all this in vaine, if a certaine way how to sayle cannot in some sort be found, but that mariners must be constrained to make their voyages doubtfully not knowing what course to keepe. Therefore

the

the ancient nauigators (thinking not without cause that there was great affinitie betweene Astronomie and Nauigation) directed all their course by the starres, the Sidonians by the lesser beare which is the certainer, the Grecians by the greater which is the clearer. But because neither star truely shewed the North part of the world, they were oftentimes deceiued in their coniectures: and because the night is not alwayes so cleare that those starres may be seene, if the skie were at any time ouercast they had no meanes wherby they might know which way they ought to guide themselues. Hereof it commeth that in ancient authors oftentimes, & in many places we see the mariners complaining of the darknesse of the nights, and that the greatest and most famous nauies haue beene dispersed and discomfited, by reason of the vncertaintie of these things.

But assuredly it seemeth to be so ordeined by nature, that all things should not be brought to light at one time: but that after a long continuance of times the certaintie of things should be knowen. There is a stone which for the exceeding great strength thereof is called Herculeus, *that is the stone of* Hercules, *& because it draweth iron vnto it, is by the Grecians called* ἡράκλειος λίθος, *cõmonly it is called by the name of him that first found it,* Magnes, *that is the Magnete or Load-stone. For it appeareth out of* Nicander *and* Plinie, *that one* Magnes *found it sticking to a sharpe pointed piece of yron. After a great number of yeeres a new propertie of that stone was reueiled, that being rubbed vpon yron, or rather vpon steele, it would make the same point to the North. Therefore when by this marueilous pointing the mariners knew the North,*

and ouer against it the South, and making account by the eleuation of the pole they learned also the latitude: then they had (as it was thought) means sufficient of infallible direction how to guide thẽselues at all times. But neither did this ioy (as many times it commeth to passe) continue long. For when they sayled from the East westwards, the Loadstone was found by litle and litle to decline from the North; which thing strooke no small doubtfulnesse and vncertaintie into the mariners mindes. Yet nowe at the length, by long obseruation of the declinations of the loadstone that haue bene diligently sought out in diuerse places and times, the matter is brought to that issue, that they which are most skilfull in the Mathematicks, and amongst them the said Count Maurice of Nassau, haue supposed that this declination of the Loadstone happeneth not by chance, but is caused by some certaine reason in nature, that according to the varietie of places the pointing of the needle should also varie.

Wherefore the said Count Maurice sent this exhortatorie iniunction (for so I may call this litle booke written by his Mathematician Steuinius) to them that take charge of ships, that if these things were not found in all points to be so as his obseruation importeth, they should do so much as in them lay, that out of diuerse experiments some certaine reason and rule of the variation might be gathered: which if it may by diligent obseruation be obteined, then there shall not onely be a more certaine way to knowe the course from place to place by the instrument made to finde the variation (of which way more shall be spoken in the booke it selfe) but the longitude also, or rather the effect of the longitude shall be giuen by the variation;

tion; which thing also shalbe shewed more at large in the Treatise it selfe following. Because therefore it is certaine that this knowledge cannot otherwise be found but by the experiments of diuers men compared togither, and that by diuers obseruations a more easie way may be prepared for science (which from the particulars ariseth vp vnto the vniuersall) I thought good to present vnto you this iniunction of the worthy Count Maurice, that if you (which are most expert in Nauigation) be of opinion that there may be so great profite of this matter as we (which thinke it to appertaine to the principall state of the common-wealth) you might doe your best endeuour vnto what place soeuer you shall come (taking with you needfull instruments for that purpose) to obserue diligently the variation of the magneticall needle, that at length we may come to that certaintie, that they which take charge of ships may know in their nauigations to what latitude and to what variation (which shall serue in stead of the longitude not yet found) they ought to bring themselues, that by this meanes they may assuredly finde what place soeuer they will in the midst of the maine Ocean sea. And although this bee the end for which principally this Booke was made, notwithstanding we make no doubt that there may many more be found no lesse profitable then this; of which sort is that which wee of late haue found, which may also be of very great profit vnto vs: To wit, that when any nauie (for which cause our common-wealth hath obteyned exceeding great renowne) is prepared against the enemie, a certaine place may be appointed in the midst of the sea, into which (if perchance too great a force should come vpon them vnlooked for) all the ships

after a certaine time might assemble themselues. Whereto I may also adioyne a third vse of the variation, that is, the reforming of many errors which must needes be in the ordinarie sea-charts, because the coasts of all countries and the courses from place to place, haue beene set downe in them by direction of the varying compasse, without abatemẽt or allowance answerable to the variation; wherof there must needes follow much deformitie and confusion in many parts of the chart, especially where the variation is great, as it is vpon the coast of Newfoundland; *where the variation being two whole points of the compasse (as it is reported) there must needes be so much error also in laying out all the sea coast of that countrey, and in the courses of all places neere adioyning in the ordinarie sea charts. All which errors may be amended, if the variations be first truely obserued, and then abated from, or allowed to the courses of all places, as neede shall require.*

But the variation cannot serue to so great vse as otherwise it might, except other errors also aswell in the chart, as in other instruments and meanes of nauigation be also auoyded. For the chart as it hath beene hitherto generally made with right-lined rumbes and degrees of latitude euery where equall, must needes be very erroneous, especially in the Northerne parts thereof, that although all the foresaid errors arising by the variation were corrected, yet for this cause onely you may bee deceiued one, two, yea three whole points of the compasse, in the courses of many places: and in measuring the distance you may erre one halfe, yea three quarters and more sometimes, accounting the same to be twise, yea thrise greater then

indeede

indeede it is, especially in farre Northerly nauigations. If therefore these so notorious errors be not also amended, the correction of the errors arising by the variation, cannot be to so great purpose as otherwise it might.

Neither can that be so fully performed which in the Treatise following is chiefly intended (that is, to find any place at sea by the variation and latitude) except the meanes that haue beene vsed for finding the latitude be also amended. For in obseruing the heigth of the sunne and starres, with the small crosse-staues which are most vsuall for that purpose, there may be error of halfe a degree, and more sometimes by neglect of the parallax or eccentricity of the obseruers eye. The Regiments or Tables of declination of the sunne that haue bene most commonly vsed by English mariners doe erre oft times ten, eleuen, or twelue minutes. The rule of allowances and abatements to be added to, or subtracted from the heigth of the pole-starre for finding the heigth of the pole (being grounded vpon a false position, to wit, that the pole-starre is three degrees and an halfe distant from the pole, when indeede it is almost 40 minutes lesse) must needes be false many times more then halfe a degree.

The declinations of the principall fixed starres as they are set downe in the bookes of Nauigation, that haue bene heretofore published, are for the most part erroneous; many of them differing from trueth aboue halfe a degree, & some of them an whole degree, yea two whole degrees and more. All which imperfections of so excellent an art, I haue since the time of my first employment at sea (now more then tenne yeeres since) by diligent search with no small labour discouered and amended, not onely by tenne whole

whole moneths experience at sea, but also by often and diligent obseruation on land, as it may more at large appeare in my booke of errors in Nauigation (which at mine own charges is also published for the common good of you all) wherein the way is shewed how your charts and crosse-staues may be freed from the errors aforesaid; and the declinations of the sunne and fixed starres are set foorth vnto you, agreeably to the trueth of the heauens found out by often and exact obseruations, whereby the latitudes of places may be found much more truely then hath beene accustomed. This Booke therefore, because it may afford needfull ayd for accomplishing the sayd renowmed Count Maurice *his desire in finding the latitude more exactly, and may also deliuer you from much inconuenience and daunger, which may necessarily be expected to follow out of so many and notable errors as hitherto haue beene in the vsuall meanes of Nauigation alreadie mentioned: I commend the same togither with this small Treatise now following vnto you all, to be dayly tried and examined by the touchstone of your long and skilfull experience at sea: nothing doubting but as they haue endured the more exquisite triall of exact obseruation, and Geometricall demonstration both by seamen and landmen on shore, so they shall be found agreeable to the heedefull experiments of all skilfull Nauigators at sea. And so with my whole heart commending you all to him whose worde both seas and windes obey, I end.*

Edw. Wright.

The hauen-finding Art,

Or

The way to finde any Hauen or place appoynted at sea.

THere is no man, I suppose, that knoweth not with howe great diligence now of a long time (especially since men leauing no part of the world vnattempted, haue sayled into *America*, and to the vtmost *Indies*) the searchers out of excellent things haue sought some certaine way, whereby they which take charge of ships might know assuredly the situation and longitude of what place soeuer they would goe vnto, and so come to any Hauen or place appointed at sea. But I know not how it hath comne to passe, that there could not hitherto any certaine knowledge of that matter be attayned vnto. For some when they indeuoured to find this thing by the magneticall needle gaue the Load-stone it selfe a Pole, which of the Load-stone (called also the Magnete) they named the magnetical Pole, or Pole of the Load-stone. But that this is otherwise, the thing it selfe hath

taught vs, becauſe the variation of the needle is found not to follow the rule of that Pole. Yet in the meane time this continuall ſearching gaue occaſion of another meane whereby a ſhip might certainly direct her courſe vnto any hauen or place at ſea whereto you would deſire to go, although the true Longitude both of the place wherein the ſhip is, as alſo of the place where the hauen is, were both vnknowen. Which that it may in ſome ſort be rudely ſhewed, and that the circumſtances hereof may more clearely be ſet foorth before your eyes, whereby there may enſue a more certaine and general vſe of the ſame, firſt of all it muſt be knowen that wee are taught by dayly experience, that the magnetical needle touched with the Loadſtone or Magnete (which therefore we call the magneticall needle) doth not alwayes point out the ſame part of the world, but without any reſpect of that magnetical Pole, (whereof we made mẽtion before) ſometimes indeed it ſheweth the true place of the North: but for the moſt part it declineth either towards the Eaſt or Weſt: which variation, yea euen in a ſmall diſtance of places, hath moſt manifeſtly appeared to them which haue directed their courſe from the eaſterne parts towards the Weſt: For examples ſake at *Amſterdam* the variation is 9 degrees and 30 min. towards the Eaſt. In the foreland of *England* 11 deg. At *London* 11 deg. 30 min. Neare *Tinmouth* in the ſea 12 deg. 40 min. and ſo forth.

How

How any Hauen or place at ſea may be found, the latitude and variation of the ſame place only being knowen.

THe variation of the magnetical needle, and the latitude of the place being knowen, the ſame place may be found, although the longitude be vnknown & that dayly experience plentifully teacheth. For (that we may make this matter plain by examples eſpecially) if the mariner know that the latitude of the citie of *Amſterdam* is 52 deg. and 20 min. and that the variation of the cõpaſſe in the ſame place is 9 deg. & 30 min. he muſt needs not be ignorant, that when he hath brought himſelfe to that latitude and variation he is not farre from *Amſterdam*, what lõgitude ſoeuer that citie haue. But ſome man may obiect, that there are many places which haue the ſame latitude and variation that the citie of *Amſterdam* hath: whereto we may readily anſwere that indeed there be ſuch places: but yet very farre diſtant from thence, and ſuch as may eaſily bee knowen by other circumſtances, whereof we ſhall ſpeake hereafter. And although the mariners may find *Amſterdam* otherwiſe, as by the places neere adioining, by coniectures, by the ſoundings, by the ſands, & many other ſignes without any regard of the variation: yet I thought good to propound a knowen place for example, that the vniuerſality of the ſame rule might be knowen in long nauigations, wherein no land appeareth. As for example if the maſter of a ſhip deſire to ſayle from hence to Cape *S. Auguſtine* in *Braſile*, and know that the variatiõ there (as it is reported) is 3 deg.

and 10 min. & the latitude 8 deg. 30 min. towards the South, when in going thitherwards he ſhall come to that latitude, and variation, he ſhall then know that he is come to the Cape of S. *Auguſtine*: and although he thinke otherwiſe by his coniecture, and reckoning, yet not regarding that coniecture he ſhall confeſſe himſelfe either to haue geſſed ill, or els to haue beene deceiued with ſome eaſterne, or weſterne currents: For reaſon will not ſuffer vs to thinke that that variation which before was found at the Cape of S. *Auguſtine* is changed, that he ſhould need to yeeld himſelfe to that opinion. So alſo who will not eſteeme it to bee abſurd, and altogether againſt reaſon, that hee which knoweth very well that he findeth at ſea another variation then that which is at Cape S. *Auguſtine*, of 3. degr. 10 min. ſhould notwithſtanding, neglecting the experience of the variation, and reſting vpon coniecture only, affirme that he is neere the Cape S. *Auguſtine*? Becauſe he ſpeaketh contrary things, when he ſayth that the variation there is 3 degrees 10 minutes, and againe auoucheth that it is not.

Neither is this vnworthy the marking, which hath often happened, that he which ſhould haue ſayled to the Iſle of S *Helena*, when he was come to the latitude of the ſame Iland, & ſaw not there the Iland, & was alſo ignorant whether he were to the eaſtwards or weſtward frõ the ſame, by coniectures ſought that place towards the Eaſt, which indeed lay frõ him towardes the weſt, & ſo the further he ſayled the further alwaies he went from that Iland. Now I leaue it to thy conſideratiõ, if he (whoſoeuer he were that was maſter of that ſhip, which diligently ſought that Iland for the

ſpace

ſpace of certaine weekes, tacking about alſo diuers times before he could find any place to abide in) if he I ſay had not bene ignorant what the variation of the compaſſe was at S. *Helens* Iland, and what the vſe of the variation is at ſea, and how to find it out: I leaue it, I ſay, to thy cõſideration, whether he would willingly haue floated doubtfully to and fro following a greater variation, knowing aſſuredly that the variation there was leſſer.

Hereby it may eaſily be conceiued how great vſe there is of the variation, when they eſpecially which in ſayling folow the lines ſhewing the courſes (which lines becauſe now they haue found this name among the Portugales we cal Rumbs, the ignorance of which (lines) can hardly be permitted in them which attẽpt long voiages vpõ the huge ocean) ought euery where to know certainly the place of the true North, which is cõmonly found by the knowledge of the variation.

If any man likewiſe conſider the vncertaine ſituation of thoſe places which are ſet into Globes or ſea Charts by the mariners relation, which vncertaintie taketh his beginning from hence, becauſe euery man thinketh that to be the true place of the North which is ſhewed by the Flower de luce (as they call it) of the compaſſe which they brought with them from home, (which thing alſo bringeth no leſſe doutfulnes to the mariners themſelues) hee will thinke (and that not without cauſe) that the obſeruation of the variation is a very needfull thing euen for this cauſe alſo: Becauſe it is an eaſie matter to place the Flower de luce in ſuch ſort that it ſhal not miſſe any thing in ſhewing the true North part of the world, to wit, if one moue

the magneticall needle, or points of the wires in the Compasse from the Flower de luce so much as neede shall require.

These things therefore hauing bene obserued and granted, and this especially that the variation altereth according to the variety of countries, (as by the common testimony of al men it is proued) it is in some sort manifest that they which denie this varying property to be of very great vse for nauigation, are either wiser then the common sort, and haue some hidden secrets which are not reueiled to euery man, or els are notable foolesand mad men.

Therefore when the most excellent Prince *Maurice*, hauing throughly considered hereof, thought that it might assuredly be brought to that passe that mariners might receiue great profit by this meanes; he (the high Admirall) gaue commaundement to all the cõpanies of the Admiralty (adioining also thereto a certaine introduction) that they should doe their best indeuour, that all masters of ships should prouide themselues for this purpose: that is to say, that to what place soeuer they should come, they should seeke out the declination of the magneticall needle from the North, or the variation of the Compasse, not lightly, running ouer the matter as it were by the way, and for fashions sake onely; but with great carefulnes and diligence, taking with them meete and needfull instruments for that purpose: and that after their returne into their countrie they should truely and faithfully certifie their companies or brotherhoods of the Admiralty, of that matter: that the selfe same experiments being by them brought into good order,

might

might be published for the common good.

But that euery man may more perfectly learne the circumstances of this matter, I thought it meete here to set downe certaine principles of this thing, which is yet notwithstanding to be further searched into by more experiments, in which shall be shewed a generall view or table of those places, whose variations haue already bene obserued by the learned Geographer *Petrus Plancius*, with continuall labour, and not without great charges, from diuers corners of the earth neere and farre off: whom for honours sake I therefore name, that as well they that shall hereafter finde out places or hauens after this manner, as also they that haue already found, may know that they are bound to giue thankes to *Plancius* alone, as to him that is the chiefe cause of this obseruation. But that table or generall viewe of variations, whereof there shall hereafter followe a plainer declaration is this.

A Table

		North-easting. Deg. Mi.	Latitude Deg. Mi.	Longitude. Deg. Mi.
The North-easting, or the East variation of the firſt part or ſpace towards the North	Increaſing. In the Flemiſh Iland *Corvo*	0 0	N 37 0	0 0
	In the Flemiſh Iland Saint *Mary*	3 20	N 37 0	8 20
	Neere the Iland *Maio*	4 55	N 15 0	11 20
	At *Palma* one of the *Canarie* Ilands	6 10	N 28 30	16 20
	At the Rocke neere *Liſbon*	10 0	N 38 55	24 30
	In the Weſtermoſt part of *Ireland*	11 0	N 52 2	24 12
	In the Weſt part of *England*	12 40	N 50 21	28 0
	Decreaſing. About one mile Eaſtward from *Plimmouth*	13 24	N 50 18	30 0
	By *Tinmouth* in the Sea	12 40	N 55 0	33 0
	At *London* in *England*	11 30	N 51 24	34 6
	In the foreland of *England*	11 0	N 51 8	35 40
	In *Amſterdam*	9 30	N 52 20	39 30
		North-weſting		
The North-weſting, or the Weſt variation of the ſecond part or ſpace towards the North	Increaſing. At *Helmſhade* to the Weſtward from the North *Cape* of *Finmarke*	0 0		60 0
	At the North *Cape* of *Finmarke*	0 55	N 71 25	61 30
	At *Norquinda*	2 0	N 71 10	63 30
	At *S. Michael* or *Archangel* in *Ruſſia*	12 30	N 64 54	83 30
	In the South ſtreight of *Vaigatz*	24 30	N 69 30	103 0
	At *Langenes* in *Nova Zembla*	25 0	N 73 20	100 30
	Decreaſing. In *Williams* Iland (In *Nova Zembla*)	33 0	N 75 35	110 0
	At *Yſhouck* (In *Nova Zembla*)	27 0	N 77 12	120 30
	At *Winterhouſe*	26 0	N 76 0	120 30

			North-easting. Deg. Mi.	Latitude. Deg. Mi.	Longi-tude. Deg. Mi.
The Northeasting of the first part or space towards the South.	Increasing.	105 Spanish leagues Westwards from *Cape S. Augustine* in *Brasile*	0 0	S	0 0
		At *Cape S Augustine* in *Brasile*	3 10	S 8 30	5 0
		North and South with *Cape das Almas* in *Guinea*	12 15	S 0 0	29 0
		Towards the Northwest Northerly frō the Ilands of *Tristan da Cuncha*	19 0	S 31 30	30 0
	Decreasing.	Towards the Northwest, Westerly frō the same Ilands	15 0	S 31 30	36 0
		North & South with the *Cape* of *Good Hope*	2 30	S 35 30	57 0
			North-westing.		
The Northwesting of the second part or space towards the South, except *Goa*, *Cochin*, and *Cantan*.	Increasing.	17 Germane miles from *Cape das Aguillas* Eastwards	0 0	S	60 0
		5 miles in the Sea frō *Terra de Natal*	4 30	S 33 0	66 0
		At the shoulds of *Indie*	11 0	S 22 0	79 30
		In *Mosambique*	11 0	S 14 50	81 40
		In the Baie of S. *Augustine* in *Madagascar*	13 0	S 23 30	83 0
		Southwards from *Cape S. Romane*	16 0	S 28 0	86 20
		In *Anthonie Gills* Baie in *Madagascar*	15 0	S 16 20	91 0
	Decreasing.	34 Germane miles Southeast from *Brandaon*	22 0	S 19 20	110 0
		In *Goa* a famous Mart towne in *Indie*	15 10	N 15 30	120 0
		In *Cochin*	15 0	N 9 45	120 0
		25 Germane miles West. a little Northerly from the Southwest corner of *Sumatra*	6 0	S 5 28	147 0
		In Bantam a Mart towne of *Iana*	4 45	S 6 0	150 0
		In the Iland *Lubocqua*	2 25	S 6 10	155 0
		In the Southwest corner from the Ile of *Balij*	1 30	S 8 40	157 0
		In the mouth of the riuer *Cantan* in *China*	0 0	N 23 0	160 0
		In *Bunam* 46 Dutch miles Eastwards from the East part of *Iana*	0 0	S	160 0

A declaration of the former Table or view of variations.

BEfore we come to the declaration of this Table, this firſt of al we would not haue vnknowen, namely, that if perchance hereafter by more diligent and more exact experience, any other variation, longitude, or latitude of places can be found, then that which is ſet downe in this Table, ſo as it ſhould be needfull to change the definitions and expoſitions of ſome things and wordes here ſet downe: yet we ought not therefore to be ſcarred from this purpoſe; but much rather ought we to ſtriue with al our ſtrength to attain thereto, that by litle and litle we may come to a more certaine knowledge of things, building vpon theſe as vpon foundations: we therefore following this opinion will proſecute that as true, which at this time is moſt like to be true; that if others alſo doe the ſame when occaſion is giuen, we may alwaies come neerer to that which is moſt true in the nature of things.

Which things being omitted, that we may come to the declaration of the former Table, firſt of all we ſay, that the firſt of the three columnes which thou ſeeſt in the table, ſheweth the variation of the place, the ſecond, the latitude, to which the third is adioyned conteyning the longitudes, as we could by coniecture attaine vnto them, that the places might ſo much the more eaſily be found in the globe, and the manner of the variations might more plainely be ſhewed in that which followeth hereafter. The marke of the letter N in the ſecond colume, ſignifieth North latitude, and S South.

Then, becauſe in them mention is made of the variation,

tion, of the Northeasting, of the Northwesting increasing or decreasing, all which (as proper words of Art) haue neede of their seuerall definitions: first of all we must know that the Magnetical needle in one and the same place, doth alwayes shewe the same part of heauen, but not the same part in all places: for in some places it pointeth due North, in other places it declineth more or lesse to the East or West. Therefore in manner of a definition, we will say thus:

The first definition.

THE declination of the Magneticall needle from the North towardes the East, is called the Northeasting, towards the West, Northwesting; and with a generall name it is called the variation: but the variation and the North-pointing of the needle (that is the pointing of the needle due North) *may by a generall name bee called the needle-pointing, or pointing of the needle.*

As concerning those words of increasing and decreasing, as also of the first and second part or space, before we come to the definitions of them, they haue neede of some precedent declaration. It may be seene in the Table of variations, that in *Corno* the Magneticall needle pointeth due North: but after that, the more a man shal goe towards the East, so much the more also shall he see the needle varie towards the East, till he come one mile to the Eastward from *Plimouth*, where the variation comming to the greatest is 13 degr. 24 min. From hence the Northeasting beginneth to decrease, til you come to *Helmshude* (which place is Westwards from the North Cape of *Finmark*) where againe

the needle pointeth due North. Now the longitude from *Coruo* to *Helmſhude* is 60 degr. Which things being well weighed, it appeareth that the greateſt variation 13 degr. 24. minutes at *Plimmouth* (the longitude whereof is 30 degr.) is in the midſt betweene the places where the needle pointeth due North. For 30 degrees is the midſt betweene the beginning and 60 degrees. And what is here ſaid of the North part, experience teacheth that the ſame taketh place in the ſouth part alſo, for 105 Spaniſh miles from Cape S. *Auguſtine* at the beginning of longitude, againe it pointeth due North, as it doth 17 Germaine miles from Cape *das Aguillas* (as it appeareth by the table of variations) which place is in the longitude of 60 degrees, and in the middeſt betwixt both at 30 degr. (as in the North part) again there is the greateſt Northeaſting; of which place there was this mention made in the Table or view of variations: *towards the Northweſt northerly from the Ilands of Triſtan da Cuncha*, where the variation is 19 degrees.

Out of theſe we may conclude, that the Magnetical needle doth point due North in euery place ſituate in two meridian halfe-circles drawen from the one pole to the other by *Coruo* and *Helmſhude*. And that the greateſt Northeaſting is in all places ſituate in the meridian ſemicircle drawen by that place, which we ſaid was diſtant one mile from *Plimmouth* towards the Eaſt. So as that part of the earth which is conteyned betweene two Meridian ſemicircles, diſtant each from other 60. degrees in longitude, is the ſpace wherein the Magneticall needle, alwayes declineth from the North towards the Eaſt. And the halfe of that part, that is, that

portion

portion of the earth which is included betweene two Meridian ſemicircles, the firſt of which is drawen by the beginning, the other by the 30 degr. of longitude, is euery where the place of the Northeaſting increaſing: but the other halfe is the place of the Northeaſting decreaſing, to wit, when one goeth from the Weſt Eaſtwards, following the order of the degrees of longitude.

By this that hath beene ſpoken of the firſt Segment, with the Northeaſting and his parts (in one of which parts the Northeaſting is increaſing, in the other decreaſing) it may eaſily be vnderſtood what the manner of the ſecond Segment is with the Northweſting, and what is the manner of the partes thereof, whereof one is the part of the Northweſting increaſing, the other is the part of the Northweſting decreaſing, for in the mouth of the riuer *Cantan* in *China*, at the longitude of 160 degrees diſtant from *Coruo*, the needle pointeth due North the third time: there therfore drawing the third Meridian ſemicircle, the portion of the earth betweene the foreſaid ſecond Meridian ſemicircle, and this third (diſtant each from other 100 degrees in longitude) ſhalbe the ſpace wherein the Magneticall needle declineth from the North towards the Weſt: and in the middle of both in the Meridian ſemicircle 50 degrees diſtant from the ſecond, and as much from the third, (or otherwiſe 110 degrees remooued from the firſt Meridian drawen by *Coruo*) ſhall be the greateſt variation of the Magneticall needle, as it appeareth out of the Table of variations in two places, whereof one is in *Willidms* Iland at *Noua Zembla*, where the greateſt Northweſting is found to be 33 degrees. The

other is distant 34 dutch miles to the Southeast from *Brandaon*, where the greatest variation is found to be 22 degrees, and the longitude of each of those places is 110 degrees. So as in the halfe of the second space (which portion of the earth is conteyned betweene the Meridian semicircles of 60 degrees longitude, and of 110 degr.) the Northwesting is euery where increasing; in the other halfe decreasing.

Of these 160 degrees of Longitude (which arch wanteth but 20 degrees of halfe the compasse of the earth) *Plancius* hath attained to the knowledge of the variation, in such sort as now we haue shewed. As concerning the other parts of the world, distant either towards the West from *Corno*, or towards the East from *Cantan*, the experiments which hitherto hee hath gotten from the Spaniards, the Englishmen, & our countriemen (the Netherlanders) doe not well agree. Neither is it any maruell, seeing they had neither perfect knowledge, nor needfull instruments for that purpose: yet he expecteth other experiments from the ships which haue now beene abroad 14 moneths and more. In the meane time we will bring forth that to publique view, which a man may without absurditie imagine.

If so be that the propertie of pointing due North, take place not onely in the three foresaid Semicircles (which we cõiecture to be Meridian semicircles drawn from the one pole to the other) but in the whole circles also; there should then be six such semicircles vpon the earth, conteyning also betweene them six partes or spaces of the vpper face of the earth.

The first with the Northeasting 60 degrees long.

The second with the Northwesting 100 degr. long.

The

The third with the Northeasting 20 degr. long.
The fourth with the Northwesting 60 degr. long.
The fifth with the Northeasting 100 degr. long.
The sixth with the Northwesting 20 degr. long.

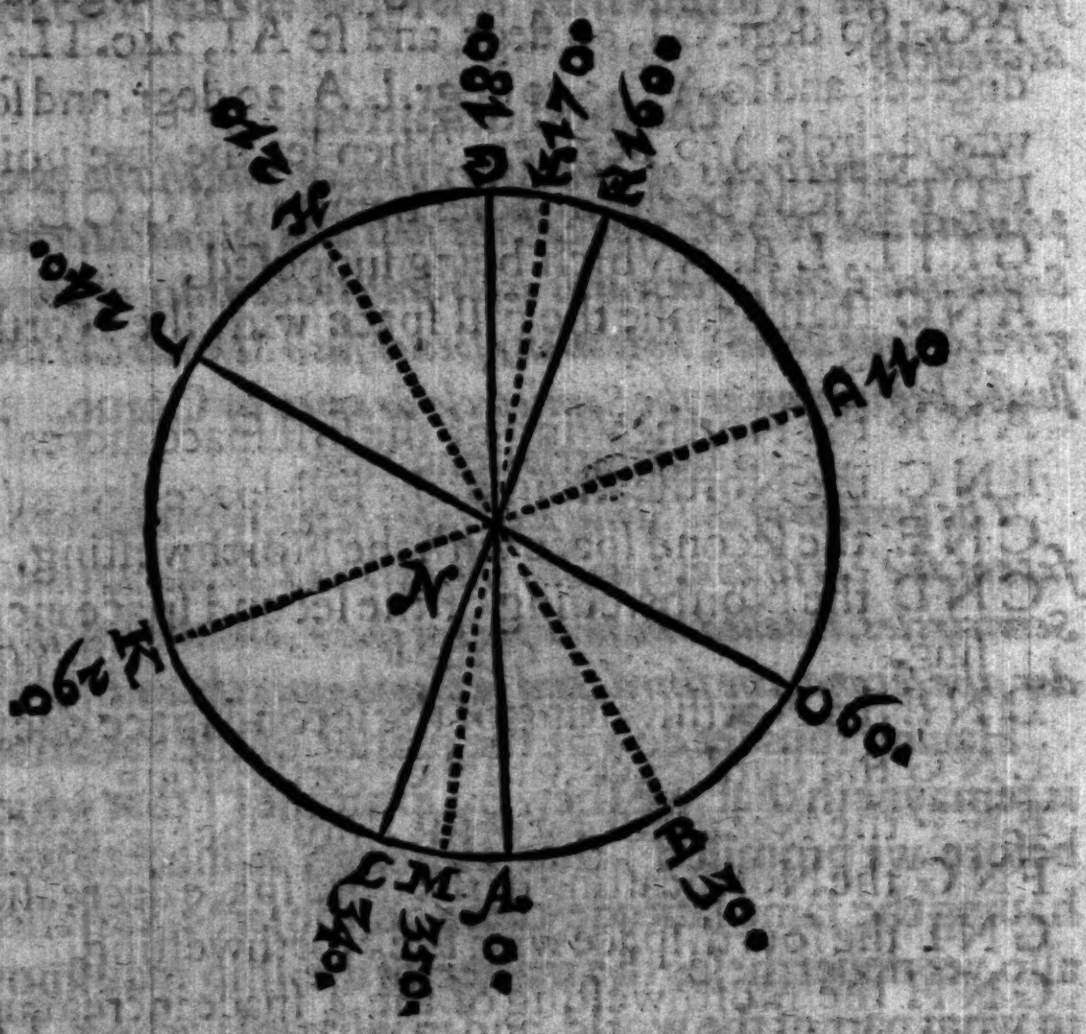
That those things which haue beene spoken may by certaine geometricall figures be more clearely conceiued, let A B C D E F G H I K L M, be the æquinoctiall of the earth: let N be the pole: then let N A bee the halfe of the first Meridian semicircle drawen by *Coruo:* N C, halfe of the second semicircle: N E, of the third: N G, of the fourth: N I, of the fifth: N L, of the sixth. So as the arch A C, may make 60 degrees: C E, 100 degr. and so A E, 160 degr. E G, 20 degr. and so A G, 180 degr. G I, 60 degr. and so A I, 240. I L, 100 degrees, and so A L, 340 degr. L A, 20 degr. and so the whole circle 360 degrees. Then let the sixe pointes B D F H K M be the middles between A C, C E, E G, G I, I L, L A. Which being supposed,

A N C shall signifie the first space with the Northeasting.
A N B the Northeasting of the first space increasing.
B N C the Northeasting of the first space decreasing.
C N E the second space with the Northwesting.
C N D the Northwesting of the second space increasing.
D N E the Northwesting of the second space decreasing.
E N G the third space with the Northeasting.
E N F the Northeasting of the third space increasing.
F N G the Northeasting of the third space decreasing.
G N I the fourth space with the Northwesting.
G N H the Northwesting of the 4 space increasing.
H N I the Northwesting of the 4 space decreasing.

I N L

INL the fift ſpace with the Northeaſting.
INK the Northeaſting of the fift ſpace increaſing.
KNL the Northeaſting of the fift ſpace decreaſing.
LNA the ſixt ſpace with the Northweſting.
LNM the Northweſting of the 6 ſpace increaſing.
MNA the Northweſting of the 6 ſpace decreaſing.

Note. Though a man may not without cauſe ſtand in doubt that the three laſt ſemicircles ſhall not bee found in the ſame ſort, which the former coniecture hath imagined, but peraduenture in a quantitie eyther greater or leſſer, and in another forme: neuertheleſſe, here the maner is rudely ſhewed how the whole world



may

may be deuided into certaine portions by such semicircles as shall hereafter bee found by obseruation. Moreouer, by that which hath beene spoken, it may easily be vnderstood what be the Northeastings or northwestings increasing or decreasing, what is the first and second Meridian semicircle, together with the parts or spaces. Which, that we may comprehend in forme of definitions, I thought good in few words thus to pronounce.

The second definition.

The Northeasting or Northwesting increasing is that whereby the variation increaseth, the Magneticall needle being caried from the West Eastwards: and the Northeasting or the Northwesting decreasing is that whereby it decreaseth.

The third definition.

The Semicircles of the Meridian, in which the needle pointeth due North, wee call the first and second Meridian Semicircles, and so forwards according to the order of the degrees of longitude, how many soeuer such Semicircles there shalbe, beginning at the Semicircle drawen by Coruo.

The fourth definition.

The portion of the Sphericall superficies, or round vpperface of the earth conteyned by the first and second Meridian Semicircles, is called the first part or space, and the rest in order, the second, the third, and so foorth vnto the end.

Hauing thus set downe the maner of the variation, it remayneth that we shew by examples (that which before we promised) that although in diuers places hauing the same latitude there be the same variation also, yet neuertheles the master of the ship may know in what part of the world, and in what place he is. Let

vs therefore againe suppose that a ship had appointed to goe from *Amsterdam* to Cape *S. Augustine*, in *Brasile*, the latitude whereof in the table of variations is set downe to bee 8 degrees 30 minutes, and the variation northeasting increasing of the first space 3 degr. 10 minutes. The same shippe sayling along by the coast of *England*, the variation shall be found to northeast or varie towards the East dayly more and more vntill you come to *Plimmouth*, where it commeth to the greatest, and is 13 deg. 24 min. Therefore the master of the ship shall know assuredly that hitherto hee hath sayled in the Northeasting of the first space decreasing, and that after this he shall haue the northeasting increasing, which when he shall find to be 10 degrees in the latitude of 38 deg. 55 min. then hee may assure himselfe that hee is come to the *Rocke* neere *Lisbone*. Going forwards again from thence as it were towards the Southwest, he shal dayly find the latitude to be diminished, and the magneticall needle declining towards the North. Or otherwise if the magneticall needle recline not towards the North, but either stand stil, or els decline more towards the East, then he may assure himselfe that hee is caried Eastwards by some secret current not perceiued: which notwithstanding he may remedy, if he goe so much the more towards the West, vntill the magneticall needle recouer his due variation. But if hee should come to the northeasting of 3 degrees 10 minutes, before he haue his Southerly latitude to be 8 deg. 30 min. he shall then indeuour as much as in him lieth to keepe that variation, and so sayle on towards the South part of the world guiding the ship so much the more towards

the

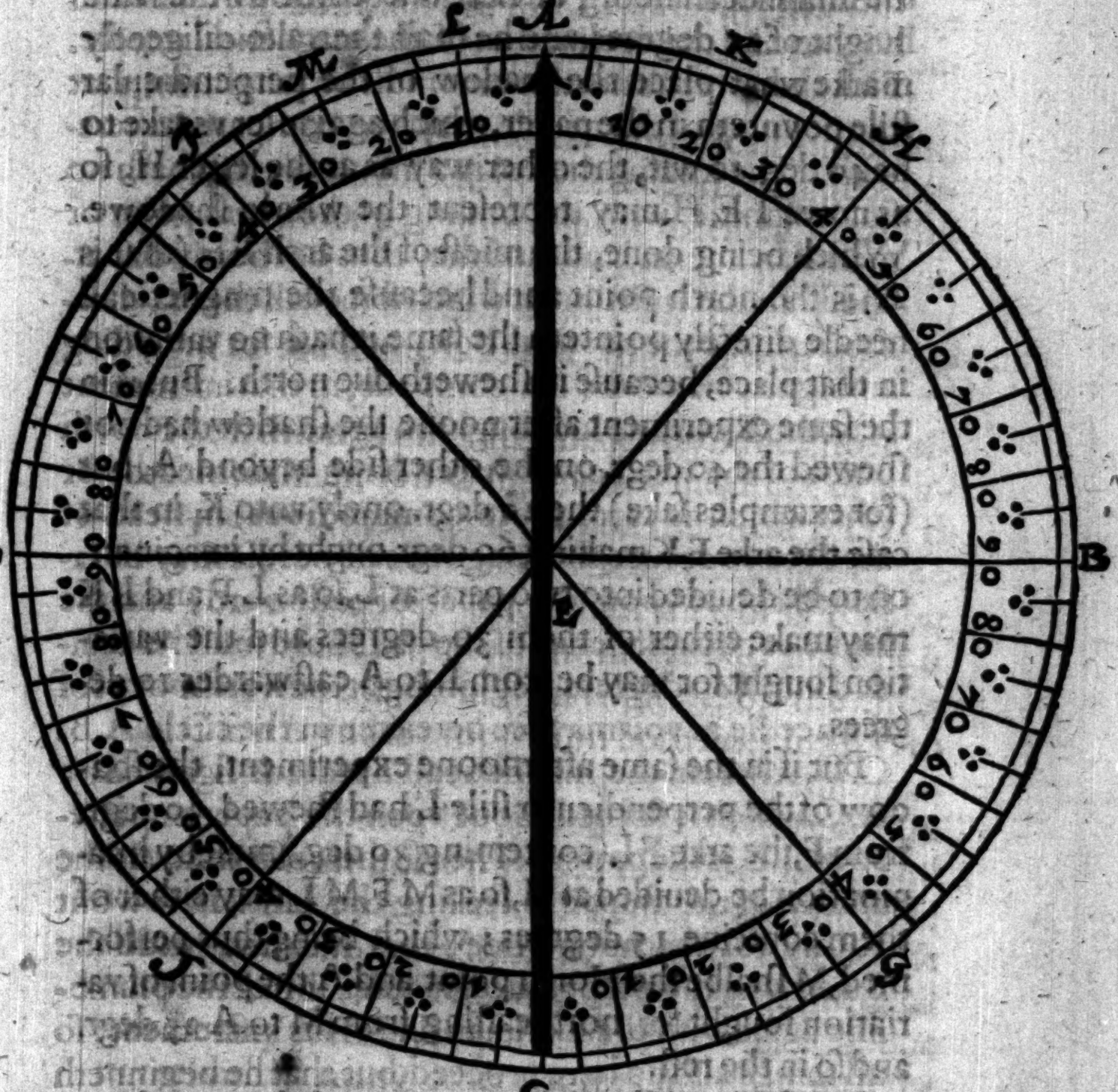
the West or East as occasion shall require. And although he may deeme otherwise by coniecture, yet he shal not follow that coniecture, for the reasons before shewed: for so comming to the southerly latitude of 8 deg. 30 min. with the northeasting increasing 3 deg. 10 min. he may assuredly perswade himselfe that he is neere Cape S. *Augustine*, whereas otherwise trusting to coniectures he may very easily misse an hundreth leagues of the place to which he had appointed to goe, not knowing in the meane time, whether he be to the eastwards, or to the westwards from thence; which experience it selfe hath also taught too much in such nauigations. And therefore the latitude and variation in all places of the earth being obserued, and the knowledge thereof published, there shall be a much more easie way of sayling about the worlde, then euer hath bene heretofore.

Hitherto we haue described the kindes of the variatiõ, which are afterwards declared out of those things which were set downe in the table of variations. If the mistris of things (experience) shal hereafter teach that any thing is otherwise, that thing may also out of the same experiẽce be otherwise defined, that the masters of ships in their nauigations may follow that only which shall bee best and most profitable.

How the North point, and the variation may be found.

ALthough the finding of the variation, (whereof hitherto often mentiõ hath bene made) is known to very many: yet we will in fewe wordes shew this thing to them which as yet peraduenture know not

the manner thereof. For here is a question or demand how to find the declination of the magnetical needle. First therfore the north point must be fought out, that the pointing of the needle may bee compared therewith. The finding thereof in a moueable ship hath no small affinitie with the finding of the north point or meridian line on land, and may thus be shortly dispatched. In the Instrument which some call the sea-directorie, some the nauticall box, and we for auoyding ambiguity name the sea-compasse, in that instrument I say, the Floure de luce ought to agree with the north point of the needle, or wires lying vnderneath: or (that which is farre more commodious) in stead of the Floure de luce the magneticall needle may be fastened aboue vpon the paper or pastboord, and the limbe or circumference of the pastboord must be deuided into 360 degrees, beginning at the north poynt of the needle as you may see hereafter in the circle A.B. C.D. wherein the magneticall needle is signified by A.C. which is fastned aboue vpon the paper or pasteboord. E. is the center. The vse thereof is this. As the master of the shippe in seeking the latitude is wont to tary for the noone-tide, that is to say, vntill the shadow of the perpendicular stile, or of the plumbline agree with the meridian line in his instrument: so all things also do here proceed, but that he beginneth three or foure houres before noone, marking diligently into which degree of the compasse, or into what diuision, the shadow of the perpẽdicular stile, or plumbline falleth. Let vs suppose therefore that he find it in the 40 deg. which we haue noted with the letter F. so as G.E.F. may signifie the whole shadow: then hee



shal seeke the height of the sunne, which for examples sake admit hee find to bee 25 degrees: which together with the 40 degrees aboue named, he shal note down for helping his memory: After this he shall attend till

the ſunne deſcending after noone come to the ſame height of 25 degrees, and he ſhall then alſo diligently marke what place the ſhadow of the perpendicular ſtile poynteth in the paper, which againe let vs take to be 40 deg. to wit, the other way as at the letter H, ſo as nowe I E H may repreſent the whole ſhadowe. Which being done, the midſt of the arch F H (that is A) is the north point: and becauſe the magneticall needle directly pointeth the ſame, it hath no variation in that place, becauſe it ſheweth due north. But if in the ſame experiment after noone the ſhadow had not ſhewed the 40 degr. on the other ſide beyond A, but (for examples ſake) the 20 degr. onely vnto K, in that caſe the arke F K making 60 degr. ought by imagination to be deuided into two parts at L, ſo as L F and L K may make either of them 30 degrees and the variation ſought for may be from L to A eaſtwardes 10 degrees.

But if in the ſame afternoone experiment, the ſhadow of the perpendicular ſtile L had ſhewed 30 degr. from F, the arke F L (conteining 30 deg.) muſt by imagination be deuided at M, ſo as M F, M L may either of them conteine 15 degrees; which being thus performed, M ſhalbe the North point, and A the point of variation ſought for, northeaſting from M to A 25 degr. and ſo in the reſt.

But if the needle onely were turned about and not faſtned to the paper or paſtborde (as before) and the degrees were marked in the margine or limbe of the box, or caſe of the inſtrument as is ſometimes vſed, there is the ſame manner of vſing it, that was before rehearſed: ſauing that in the beginning of the obſerua-

tion,

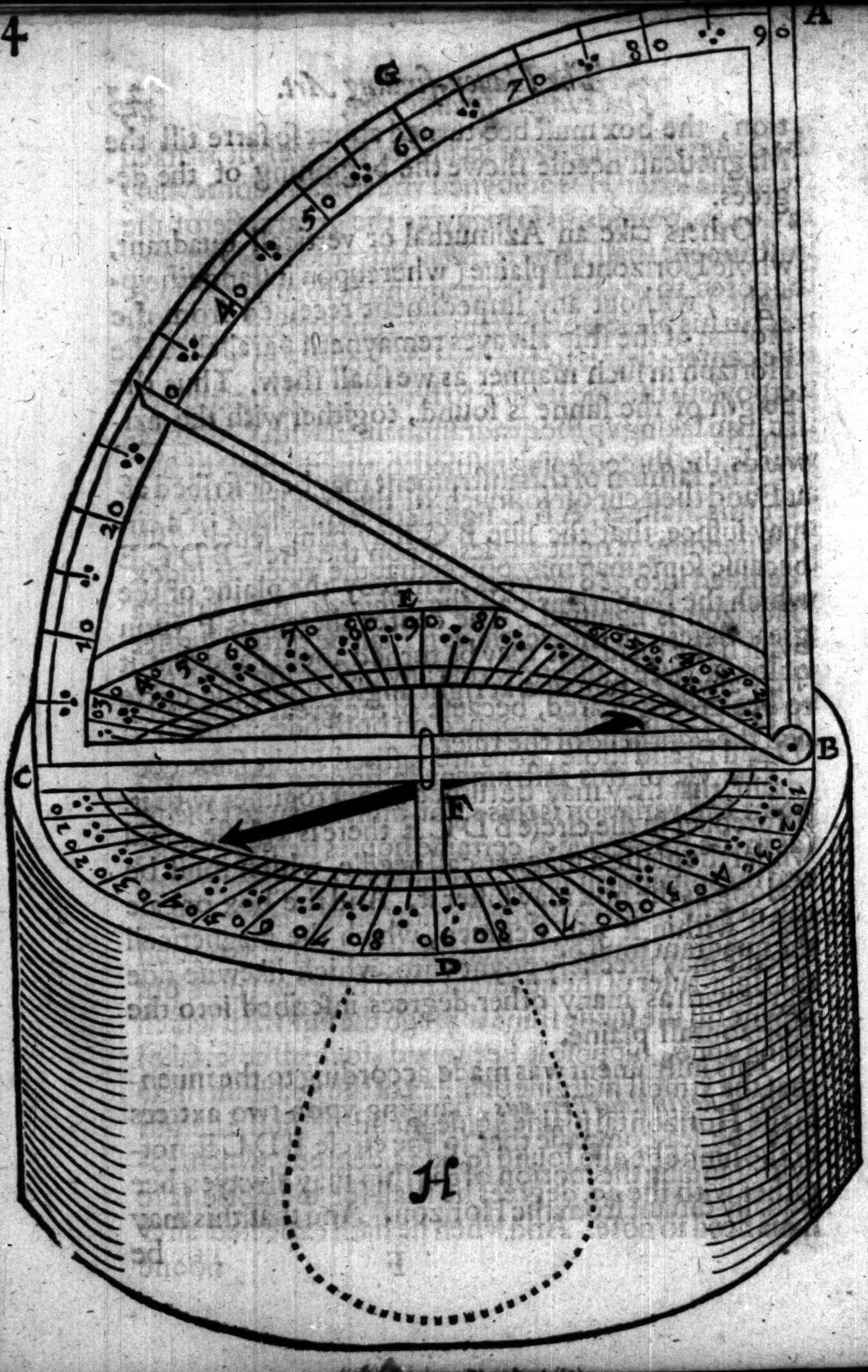
tion, the box must bee turned about so farre till the Magneticall needle shewe the beginning of the degrees.

Others take an Azimuthal or verticall quadrant, whose Horizontall plaine (whereupon it standeth vpright) without any impediment receiued from the motion of the ship alwayes remayneth parallell to the Horizon in such manner as we shall shew. Thus the heigth of the sunne is found, togither with the azimuth.

The fashion of this instrument may be described after this manner, A B C signifieth a quadrant of a circle standing at right angles. Vpon the circle B D C E deuided into 360 degrees, whereby the plaine of the Horizon is signified. The center thereof is F vpon which the quadrant may be turned about: and that it may alwayes remaine at right angles vpon the circle B D C E it is vnder-propped on both sides from G to D and E, and those props are fastned to the same quadrant, that they may be turned about togither with it. Moreouer in the circle B D C E there is a glasse, and vnder the glasse a magneticall needle, which must be so long as the box may suffer it. And the box or case hath within it 360. degrees, which the magneticall needle may precisely poynt vnto, which likewise doe agree with as many other degrees inscribed into the horizontall plaine.

This instrument was made according to the inuention of *Reginaldus Petræus*, hanging vpon two axtrees like the sea-compasse that so the circle B D C E notwithstanding the motion of the ship may alwayes bee equally distant from the Horizon. And that this may

be


A
G
E
B
C
F
D
H

be done with the greater ſecuritie, the weight marked with the letter H is adioyned vnderneath, conteyning 25. or 30. pounds, or ſo many as the greatneſſe of the inſtrument ſhall require. But this alſo is worthy to be noted, to wit, that the quadrant perpendicularly erect in his place is of the ſame weight on both ſides of the center: that is to ſay, the ſide from F to C counterpoyſeth the ſide from F to B which may be knowen if a man taking vp the quadrant, hang it with G downewards, the threed being faſtned in the middeſt of B C at F and then cut off ſo much of the heauier part, as may ſuffice, that the line B C may hang leuell. But becauſe ſome man may obiect that the ruler or index which the Barbarians call the *Alhidada*, may bring a great varietie in the weight as it ſhall be turned higher or lower: wee muſt know that any ſuch thing need not to bee greatly feared, becauſe of the great weight H and the lightneſſe of the ruler.

The vſe of this inſtrument in finding the North point and variation is this: you muſt begin to obſerue (as in the former kind) certaine houres before noone, and the inſtrument muſt be turned vntill the magneticall needle point to the beginning of the circle: then the quadrant muſt be turned this way or that way, and the ſight-ruler of the quadrant muſt be lifted vp, or put downe till the ſunne ſhine through the ſight. All which being done, ſuppoſe it bee found (for examples ſake) that the vtmoſt margine or index of the quadrant ſhew in the Horizontal plaine 40. degr. and admit the heigth of the ſunne be alſo found to be 25. degrees, which together with the 40. degrees he ſhall for memorie ſake haue need to note. And when he hath expected after

noone till the ſunne deſcending by the ſame inſtrument be found placed in the ſame 25. degr. of altitude, then the box it ſelfe muſt againe be turned this way or that way, vntill (the ſunne againe ſhining through the ſights) the magneticall needle doe point to the beginning of the circle. Which things being thus diſpatched, the middle point of the arch in the horizontall plaine betweene the firſt and ſecond experiment is the North point, and how much the needle declineth from that point, ſo much is the variation ſought for, as before wee haue ſhewed in the firſt example more at large.

Whatſoeuer we haue affirmed to be availeable in the day time, in theſe experiments of the ſunne, the ſame may bee vnderſtood and done in like manner in the night, by any of the fixed ſtarres, whereof there is the ſame vſe in this matter that there is of the ſunne. But there is not the ſame reaſon of the moone, aſwell becauſe of the ſwiftneſſe of her proper motion; as alſo becauſe of the greatneſſe of her parallax (as they call it) which the ouermuch neereneſſe of the moone to the globe of the earth bringeth forth. But this alſo is to be noted that two, three, or foure, yea and more obſeruations may be made in the fore-noone. As for example let the firſt bee when the ſunne is 10. degrees aboue the horizon, the ſecond when it is 15. degr. the third when it is 20. degr. and if any man will make triall as often after noone, hee ſhall ſee how euery experiment agreeth with other: and when at euery moment the ſame North point is found, that thing ſhall giue the maſter of the ſhip no ſmall courage, and more certaine confidence of his worke.

But notwithstanding, when the mariner sayleth from the East Westwards, or contrariwise from the West Eastwards, it may be that in the space of 10 or 12 houres between the first and second experiment, there may be difference of one degree or more in the variation, whereof may follow that the North poynt found by the first forenoone obseruation, and the last in the afternoone, shall not agree with that which was found by the first in the afternoone and the last in the forenoone: when notwithstanding the mariner hath not erred in obseruing.

Which if it shall happen often, the skilfull mariner may iudge thereby what difference of variation is answerable to any determinate time of sayling, and so finde a way whereby the North poynt may bee found with more certaintie and securitie: which thing may thus also be done, if a man diligently compare the variation found in the former dayes with the variation which he presently seeth.

FINIS.